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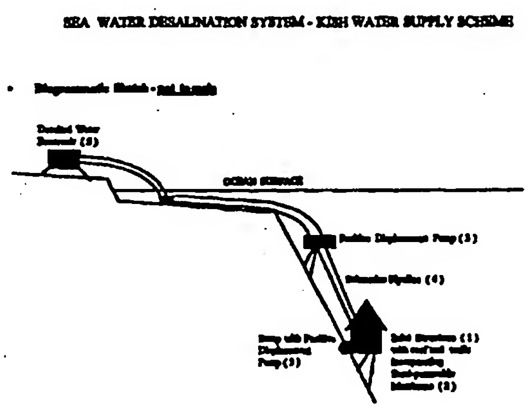

(57) Abstract

The system consists of the construction of modular deep sea inlet units (1) into which are incorporated flat sheet semi-permeable membranes (2) that produce high quality desalted water using the reverse osmosis process. The modular devices are sunk into the ocean to the appropriate depth anywhere along the continental shelf. The desalted water is collected and brought by appropriately designed and constructed modular sleeved pipeline (4) with compressed air driven positive displacement pumps (3) to shore based service reservoirs (5) to supply consumers by means of conventional aqueducts. The modular construction of the scheme allows the pipeline (4), pumps (3) and inlet units (1), due to the attached buoyancy device, to be floated to the surface for maintenance and repair. The configuration of the membranes allows self-cleaning. This cleaning action and brine removal is further enhanced by forcing high pressure air and water to flow past the membranes. The high pressure seawater and the product desalted water are separated to prevent contamination. The whole system would be automatically monitored and controlled from operation stations on the shore or from seagoing crafts. Marker buoys on the surface indicate the location of the inlet units.

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Invention Title

SEA WATER DESALINATION SYSTEM - KISH WATER SUPPLY SCHEME

The following statement is a full description of this invention, including the best method of performing known to me:-

Throughout the world and in Australia in particular there are shortages of adequate water for industry, agriculture and municipal use. A seawater desalination process is required that produces relatively cheap and abundant quantities of desalted water for the varied consumers.

This invention relates to the provision of an alternate water supply scheme, the KISH ("Keep Irrigating for Sufficient Horticulture") Water Supply Scheme (KWSS), that produces from seawater abundant desalted water for coastal cities, new inland Canberra-type cities and water for inland municipal, industrial and irrigated agriculture uses.

The existing Reverse Osmosis (R.O.) and other desalination processes are resource and energy intensive and provide limited quantities of water. The KWSS seeks to provide relatively cheap and abundant quantities of desalted water for the varied consumers to assist development.

The system - a number of modular devices, using the Reverse Osmosis principle, are sunk into the ocean to the appropriate depth anywhere along the continental shelf. These devices desalt the seawater - in effect the salt is filtered out of the water. The desalted water is collected and brought, by means of large diameter pipes, to service reservoirs on the shore. From here it is distributed by means of conventional aqueducts to consumers be that municipal, industrial or inland irrigated agriculture.

The quantities envisaged for each module would be of the order of 250ML/day which is similar to Canberra's, a large Australian inland city's water needs. As an example of the feasibility of the scheme, in pumping water long distances under the sea, the submarine pipeline from Malaysia to Penang Island carries 230ML/day in twin 1100mm steel pipes between Penang Island and Butterworth - a distance of several kilometers.

In Patent Application PCT/US93/11100 (Patent withdrawn in 17/8/1995) a desalination method and apparatus are disclosed using R.O. The method consists of the positioning the separator means, establishing communication between the separator means and seawater, removing salt by forcing the seawater through the separator and transporting the desalted water to storage tanks.

However PCT/US93/11100 does not contemplate the means for controlling the flow of the separator water to ensure that the seawater salinity is appropriately reduced to required levels. This aspect is critical in maintaining an acceptable level of the final salinity of the desalted water.

OBJECTS OF THIS INVENTION

The aim of this invention is a **complete system of water supply**, for municipal, industrial and inland irrigated agriculture use, from deep sea seawater desalination. The individual objectives are:

- the production of large quantities of desalted water suitable for human consumption by means of the deep sea application of reverse osmosis to desalt the seawater and convey the desalted water to storage reservoirs on the shore;
- the use of flat sheet semipermeable membrane technology incorporated into modular deep sea inlet structures;

- the self cleaning action of the membranes enhanced by forcing high pressure air and water, emitted from the inlet structures, to circulate the water past the membranes washing the brine away from the membrane surfaces;
- the maintenance and repair of the system items, like the inlet structures, by means of floatation to the free sea surface;
- the raising of the whole system as one entity or possibly in modules through incorporated buoyancy devices;
- the prevention of contamination of the desalted water through the separation of the high pressure seawater from the product desalted water;
- the means for monitoring and control of the flow of the desalted water to ensure that the salinity is appropriately reduced to the required levels;
- the incorporation of pumping means, for example compressed air driven **positive displacement pumps,** that push the product water through **conveying means,** for example **large diameter sleeved pipes,** that resist the deep sea pressures;
- the complete automatic system monitoring and control from the shore or from sea craft operation stations with maker buoys indicating the inlet units;
- the provision of in-ground or above ground aqueducts to carry the product water to inland service reservoirs and consumers, as aqueducts are cheaper than pipelines.

SUMMARY OF THE INVENTION

LEGEND - refer to Fig 1

BTT	Buoyancy Trim Tank	FPDW	First Pass Desalted Water
HPC	High Pressure Chamber	SPDW	Second Pass Desalted Water
LC	Lower Chamber	LCM	Lower Chamber Membrane
RCM	Roof Cavity Membrane	PPC	Perforated Protective Casing
IV	Inlet Valve	OV	Outlet Valve

The seawater desalination system comprises of one or more deep sea intake units. Each unit is fitted with semi-permeable membranes capable of desalting seawater by

means of reverse osmosis (R.O.) in one or more passes. The units are located at a predetermined depth below the free sea or ocean surface, depending upon the incorporated R.O. membrane operating characteristics.

The roof of the intake unit, is so shaped that the incorporated flat sheet semi -permeable membranes are self cleaning by enabling the sea or ocean slime, sludge and brine to slide off, wash away, the leaving the membranes fully functional.

The incorporated flat sheet semi-permeable membranes pass the high pressure seawater through as desalted water by means of the reverse osmosis (R.O.) process to produce the First Pass Desalted Water (FPDW). This water is collected and stored at the base of the roof structure. (Refer to fig. 1)

The roof inside cavity is either evacuated or the remaining air within the cavity is kept at low pressure, to provide the necessary pressure differential for R.O. operation.

Below the roof cavity the intake unit contains a high pressure chamber (HPC) with the control means to control the flow of product FPDW depending on the level of salinity required. The control means are one or more inlet or outlet valves allowing the stored FPDW, within the base of the roof cavity, to enter and exit the HPC.

As the inlet valves to the HPC open, the FPDW at low pressure enters and fills the HPC. The outlet valves are closed. To remove the FPDW from the HPC, the HPC inlet valves close and the outlet valves open and high pressure air is forced into the HPC to enable the FPDW to pass from the HPC to enter a lower chamber (LC) at the base of the inlet structure.

This LC contains flat sheet semi-permeable membranes, possibly elliptical, but so shaped that the membranes are self cleaning by enabling the brine to wash away from the membrane leaving it clean and continuously fully functional.

The FPDW passes through these membranes as the Second Pass Desalted Water (SPDW). There are control means here also to control the flow of product desalted water depending on the level of salinity of the product SPDW. The control means are outlet valves at the base of the LC. If the salinity is high the control valve isolates the contaminated SPDW, in that module, from the product desalted water to prevent further contamination. The rise in SPDW salinity may be due to seawater infiltration through membrane rupture or other means.

The SPDW is gathered in sumps in the LC or may flow to other sumps of other intake units where there are pumping means positioned in the unit or units to convey the desalted water through conveying means (large diameter pipes or conduits) to storage and service reservoirs on the shore.

A proportion of the feed FPDW passes through the membranes as SPDW, the remainder flows past the membranes cleaning them, removing the brine and exiting the LC through outlet valves.

The exiting feed FPDW forces the outside seawater to be circulated past the roof semi-permeable membrane and enhances its cleansing and brine removal.

To further assist the roof semi-permeable membrane cleansing and brine removal, as the HPC is evacuated, by means of the air eductors of the high pressure air to the outside seawater, the exhaust air also contributes to the outside seawater circulation past the roof semi-permeable membrane.

The process steps, as described, are repeated in the entry of the stored FPDW to HPC.

DETAILED DESCRIPTION (refer to Figure 2)

The present invention provides for modular devices in the form of deep sea intake units or structures, appropriately designed and constructed, to be sunk into the ocean anywhere along the continental shelf, to an approximate depth of 600 meters below the free sea or ocean surface - where the water pressure is compatible with the R.O. membrane operating requirements.

<u>Sketch</u> To assist with understanding the invention reference will now be made to the accompanying sketch. These diagrammatic sketchs show one example of the invention.

In this form of the invention the **Deep Sea Intake Units** consist of **Inlet Structures** (1) which are appropriately sized and adequately strong, in possibly elliptical form and configured as shown. Incorporated into the roof are **flat sheet semi-permeable membrane modules (2).** These membranes, according to the reverse osmosis process, in effect act similar to filters and desalt the seawater as the water from the outside at high pressure passes through the membrane into the evacuated roof cavity. The salt concentration of the water outside the membrane is increased raising its density. This increased density causes the brine and any incident slime/sludge to sink away from the membrane surface leaving the membrane clean and fully functional.

To assist the removal of the brine from the membrane surface compressed air and water is emitted from the unit and circulates the brine away from the membrane.

If the quality and salinity of the product desalted water is unacceptable then **more than one pass of the saline water** over the appropriate semi-permeable membranes may be necessary. If the first pass desalted water (FPDW) is unacceptable the invention allows for, within the structure in one or more chambers, for a second pass desalted water (SPDW) and possible later passes.

The desalted water inside the structure collects in sumps from which it is removed by compressed air driven **positive displacement pumps, (3)** and pushed through **large diameter sleeved pipes (4)** to the **service reservoirs** (5) on the shore. The water salinity inside and outside the conduits, together with the pump operation, is automatically controlled from sea surface craft or shore based operation stations.

Only a proportion of the high pressure seawater permeates through the membranes becoming desalted water. The remainder, within the unit lower chambers, flows past the membranes cleaning them, removing the brine and exiting the lower chamber through outlet valves. This product SPDW is then pumped through large diameter pipes or conduits to service and storage reservoirs on the shore.

The roof of the inlet structures is shaped to allow any ocean slime or sludge or even the remaining brine outside to wash away leaving the membranes clean and fully functional. The self cleaning action of the membranes is enhanced by forcing high pressure air and water, emitted from the structure, to circulate the seawater past the membranes. The membranes may be **appropriately corrugated** to increase the surface area available to the high pressure seawater outside.

<u>Desalted Water</u>

The seawater outside the deep sea inlet structure is of sufficient pressure (approx. 800 psi, 60 kg/sq.cm) to drive the water through the semi-permeable membranes, fitted into the roof, desalting it in the process by means of reverse osmosis. Inside the structure, the desalted water, at low pressure, is gathered in sumps from where it is lifted at low pressure, large quantities and pushed by large compressed air driven positive displacement pumps, through large diameter sleeved pipes, to service reservoirs on the shore.

The type of semi-permeable membrane determines the configuration of the inlet structure in whether a single pass or more passes of feed water are required, over the semi-permeable membranes, to achieve the required quality of desalted water.

The final desalted water is expected to be of high quality as it is drawn from approx. 600 metres below the sea or ocean surface where the water is **relatively free of organic and inorganic pollution.** The water in the service reservoirs, prior to distribution, may or may not require further treatment depending on the type and quality of membrane used in the process.

System Structure

The structure of the system is in **modular form**, to enable complete isolation of any one of the items, membranes or any one of the intake units for repairs and maintenance. The modules may be possibly held together by pressure clamps of the high pressure seawater and released through the operation of compressed air.

For **maintenance and repair purposes** the conduits, pipes and pumps are also constructed in modules. Each module, according to need, may be separated from the system and floated to the surface for appropriate maintenance and repair. The whole system may be raised to the surface, using the buoyancy and trim tanks attached to the elements of the system.

Another Form of Invention

In another form of the invention, existing proprietary reverse osmosis units comprising of hollow-fine-fibre (HFF) permeators or spiral wound membranes may be used. These proprietary units may be installed within the intake structures which may be located below the surface or even on the free sea surface or on the shore. The outside sea water, at the appropriate high pressure, would be pumped through these units and past the hff and membranes. The desalted water would percolate through the hff and membranes, exit the unit and be pumped to the shore reservoirs. Considerable volume of high pressure seawater, must be pumped through the units.

At present (April 97) unit efficiency is approx. 50% and some water pretreatment may be necessary depending on the type of hff and spiral wound membrane used.

INVENTION DETAILS - SYSTEM ITEMS

Deep Sea Inlet Structures (1)

The Deep Sea Inlet Structure would be evacuated, or at least be at a low internal pressure to facilitate the reverse osmosis process. It would be modular, appropriately sized and adequately strong to withstand the high water pressures outside. It may be of any suitable material, for example, high strength non corrosive steel suitable for naval submarine construction. The desalted water, to prevent possible contamination, is separated from the outside seawater.

The structure would be modularised to allow the complete isolation of any membrane that may have ruptured, or structure portion that may leak and allow the ingress of the high pressure sea water from the outside. In each module there is a valve at the base of the structure which controls the flow of desalted water and this valve would automatically close when the salinity of the desalted water rose above acceptable levels. This way contamination of the desalted water would be prevented.

The water salinity and quality, inside and outside the structure, would be continuously monitored remotely from sea surface craft or shore installations. The system operation would be fully automated.

Construction, Maintenance and Repair

The complete modules consisting of pipeline, pumps, power lines and inlet tanks or conduits would be constructed on shore, positioned off shore and sunk to the predetermined depth and location. For maintenance and repair the modules would carefully be floated to the surface through the activation of attached buoyancy devices similar to a naval submarine's buoyancy and trim tanks. The length of the

module would be determined by the actual location. Marker buoys would locate the unit.

An **alternative maintenance and repair method** would be through submersibles or appropriate diving bells encompassing the module.

Semi-permeable Membrane (2)

The semi-permeable membrane may be proprietary or custom made to fit into the roof structure and within the chambers of the unit or inlet structure. These membranes can be produced in country under licence to the manufacturers. The membrane may be produced with **corrugations** to increase the surface area available to the high pressure seawater outside.

It should be noted that the functional requirements of the semi-permeable membrane determine the depth to which the inlet structure needs to be located, to attain the necessary pressures for reverse osmosis, and the number of saline water passes over the membranes to achieve the required quality of the desalted water.

Pumping Means - Positive Displacement Pumps (3)

At present positive displacement pumps, that are used for the pumping of concrete long distances and to great heights in building construction, can push water horizontally up to distances of one kilometer. So it may be possible to modify these existing pumps to meet the requirements of this application. However the pumps in this application would need to be low pressure high quantity positive displacement pumps, possibly driven by compressed air and incorporated into the pipeline. The pumps need to be appropriately designed, sized and constructed to meet the deep sea conditions.

Conveying Means - Submarine Pipeline (4)

The submarine pipeline, comprising of large diameter pipes or conduits, carry the desalted water from the inlet structure to the service reservoirs on the shore and may be similar to existing submarine pipelines throughout the world. Incorporated into the pipeline would be the compressed air driven positive displacement pumps. The number of pumps would be determined by the pipeline operating conditions.

The pipeline would need additional protection against deep sea conditions by the fitting of appropriate sleeving, consisting of buoyancy and trim tanks, and cathodic protection. For maintenance and module repair purposes the pipeline would be floated to the surface using the appropriately designed and constructed buoyancy tanks. The buoyancy and trim tanks can be remotely activated allowing the pipeline to be carefully floated to the surface as a single entity, together with the other fittings which also may require maintenance and repair.

Other Scheme Elements (5)

The remaining elements of the Kish Water Supply Scheme (KWSS), for example the **on-shore desalted water service reservoir** not mentioned above, would be appropriately designed, sized and constructed as similar to conventional water supply projects. All elements KWSS are to be compatible with each other.

To carry the product water to **inland service reservoirs** and consumers, **in-ground or above ground aqueducts** need to be appropriately designed, sized and constructed as similar to conventional water supply projects. Aqueducts are cheaper than conventional pipelines.

POWER REQUIREMENTS

Power would be required mainly to produce the compressed air to operate the system, drive the positive displacement pumps, activate the buoyancy devices as required and to drive the remote control equipment. In conventional water supply schemes the power requirements, in the main, are for the pumping and pretreatment

of the water. In the KWSS it is expected that, due to the intake depths, no water pretreatment would be required with consequent savings in power requirements. The existing reverse osmosis schemes, for example in Malta, are more power intensive due to the need for high pressure pumps and significant water pretreatment.

COST COMPARISON

In the main, the majority of the scheme elements, including the pipeline and pumps are similar to the elements of conventional water supply schemes. The major difference is the deep sea inlet structure which is small in comparison to a water reservoir's huge concrete dam wall which holds back a lake of rain water. Regarding the existing reverse osmosis water supply schemes in use in Malta and Bahrain, the KWSS would eliminate the need for high pressure pumps and pretreatment of the incoming sea water. Considering the above it would appear that the KWSS is cheaper to build and operate than conventional water supply systems and existing reverse osmosis schemes.

BENEFITS

The singular greatest benefit of the Kish Water Supply Scheme is the supply of abundant desalted water to varied consumers at apparently competitive or even lower cost per kilolitre than from conventional water supply, or proprietary high pressure reverse osmosis schemes such as used on Malta or Bahrain. There is no need for large dams and reservoirs which flood vast tracts of land.

Abundant desalted water is available to meet the needs of coastal cities, possible new inland Canberra-type cities and for inland municipal, industrial and irrigated agriculture uses.

CLAIMS

The claims defining the invention are as follows:

1. A seawater desalination system comprising; one or more seawater intake units, located at a predetermined depth below the free sea or ocean surface, each unit comprising therein one or more semi-permeable membranes capable of desalting seawater by means of reverse osmosis, in one or more passes, with one of the said membrane(s) forming a roof membrane of an intake structure of the said unit adapted for the first pass, said unit or units further incorporating the other membranes for the other passes; control means to control the flow of product desalted water depending on the level of salinity thereof; pumping means positioned in said unit or units to convey the desalted water through conveying means to storage and service reservoirs on the shore.

2. A system as claimed in claim 1 wherein cleaning of the roof membrane is enhanced by means of high pressure streams of water or compressed air exiting from each of the said intake units to forcibly circulate sea water past the roof membrane.

3. A system as claimed in any one of the above claims wherein the membranes within the said units are so shaped that they are self cleaning to enable sliding slime, sludge and brine off the semi-permeable membranes leaving said membranes clean and fully functional.

4. A system as claimed in any one of the above claims wherein said membranes contained by the units are corrugated to provide greater surface area for reverse osmosis but not affect the membrane self cleaning characteristics.

5. A system as claimed in any one of the above claims wherein the structure of the system is in modular form, to enable complete isolation of any one of said

membranes or any one of said intake-units for repairs and maintenance, with the modules possibly held together by the high pressure seawater and released through conventional pressure clamps operated by compressed air.

6. A system as claimed in any one of the above claims wherein the semi-permeable roof membrane of the intake structure is protected by perforated casing into which are incorporated buoyancy and trim tanks for floatation and buoyancy purposes of the system to the free sea surface.

7. A system as claimed in any one of the above claims wherein float control means are attached to each module of the system to allow controlled float of the system or one or more modules up to the free sea or ocean surface.

8. A system as claimed in claim 7 wherein said float control means is a buoyancy means.

9. A system as claimed in claim 8 wherein said buoyancy means allow shore-based construction of the system.

10. A system as claimed in claim 8 or 9 wherein said buoyancy means allow floating and/or sinking of the system or one or more modules at an appropriate location to an appropriate depth below the free sea or ocean surface.

11. A system as claimed in any one of the above claims wherein cathodic protection is used to protect the system or one or more modules to withstand the deep sea environment.

12. A system as claimed in any one of the above claims wherein said conveying means have appropriate sleeving to resist the deep sea pressure and as a means of incorporating buoyancy and trim tanks.

13. A system as claimed in any one of the above claims wherein said conveying means are large diameter pipes or conduits which are fitted with pumping means, such as positive displacement pumps, appropriately designed and constructed to withstand the deep sea high pressure environment.

14. A system as claimed in any one of the claims 6 to 13 wherein said buoyancy and trim tanks, appropriately designed and constructed to withstand the deep sea high pressure environment, are remotely activated to allow for sinking or floating of the entire system or possibly one or more modules of the said system up to the free sea or ocean surface.

15. A system as claimed in any one of the above claims wherein said pumping means are driven and operated by compressed air.

16. A system as claimed in any one of the above claims wherein the said pumping means are positive displacement pumps driven and operated by compressed air of pressure adequate for effective pumping.

17. A system as claimed in any one of the above claims wherein said pumping means are positioned in sumps attached to each said intake unit and within the conveying means.

18. A system as claimed in any one of the above claims where the means for the flow of the desalted water from the intake units are outlet valves.

19. A system as claimed in claim 13 wherein said pumps operate automatically, are of low maintenance construction and of high reliability.

20. A system as claimed in any one of the above claims wherein all or any monitoring and control operations are carried out from operation stations,

shore based or located in floating crafts on the sea surface. The location of the intake units is indicated, on the surface, by the appropriate maker buoys.

21. A method of desalinating sea water , the method comprising the steps of:

(a) passing sea water at high pressure through one or more inlet structures, located at a predetermined depth below the free sea or ocean surface, each inlet structure having a substantially elliptical roof, in vertical cross section, with the roof inside cavity evacuated or the remaining air within the cavity kept at low pressure, the roof fitted with flat sheet semi-permeable membranes desalting seawater by means of reverse osmosis to produce the First Pass Desalted Water (FPDW), the inlet structure below the base of the roof cavity containing a high pressure chamber (HPC) with one or more inlet or outlet valves;

(b) storing the FPDW within the base of the roof cavity;

(c) opening the inlet valves to the HPC to enable the FPDW to enter the HPC with the outlet valves closed;

(d) closing the HPC inlet valves and opening the outlet valves;

(e) forcing high pressure air into the HPC to enable the FPDW to pass from the HPC to enter a lower chamber (LC) at the base of the inlet structure, containing elliptical flat sheet semi-permeable membranes through which the FPDW passes as Second Pass Desalted Water (SPDW) and outlet valves to control the flow of the SPDW depending on the level of its salinity;

(f) conveying the SPDW by pumping to service reservoirs on the shore;

(g) causing the FPDW feed in the LC to flow past the membranes cleaning them, removing the brine and exit the LC through outlet valves;

(h) forcing the outside seawater, by the exiting feed FPDW, to be circulated past the roof semi-permeable membrane and enhance its cleansing and brine removal;

(i) evacuating the HPC of high pressure air to the outside seawater, by means of air eductors, the exhaust air contributing to the outside seawater circulation past the roof semi-permeable membrane to enhance its cleansing and brine removal;

(j) opening the HPC inlet valves, closing the HPC outlet valves and allowing the stored FPDW, at the base of the roof cavity, to enter the HPC repeating the process steps defined above.

22. A method as claimed in claim 21 wherein the method comprising the step of delivering high pressure streams of compressed air and feed water to forcibly circulate the water past the membranes to enhance the cleaning of each said membrane.

23. A seawater desalination system substantially as herein described with reference to the accompanying drawings.

24. A method of desalinating water substantially as herein described.

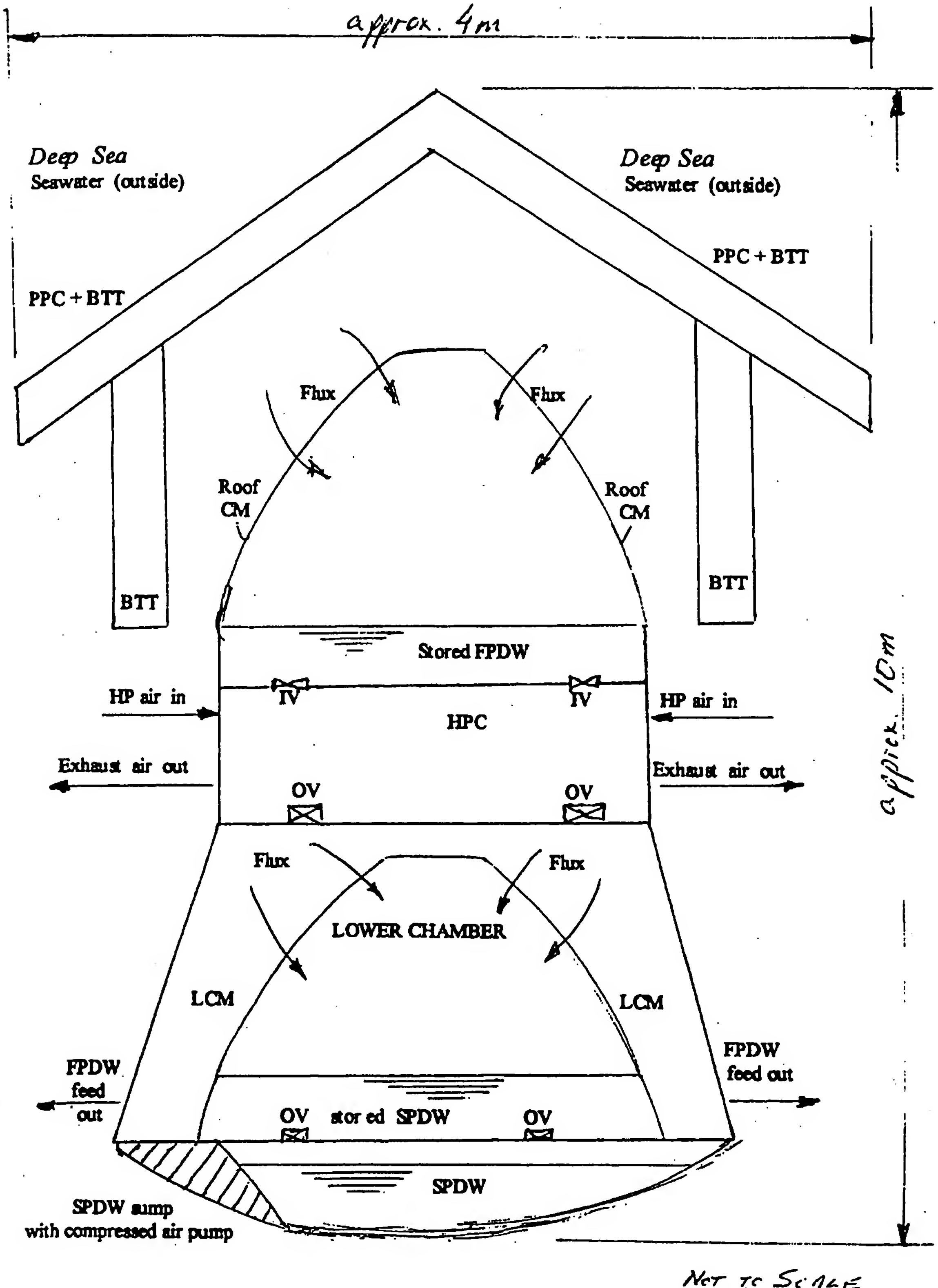
approx. 4m
Deep Sea
Seawater (outside)
Deep Sea
Seawater (outside)
PPC + BTT
PPC + BTT
Flux
Flux
Roof
CM
Roof
CM
BTT
BTT
Stored FPDW
IV
IV
HP air in
HP air in
HPC
Exhaust air out
Exhaust air out
OV
OV
Flux
Flux
LOWER CHAMBER
LCM
LCM
FPDW
feed
out
FPDW
feed out
OV
stor ed SPDW
OV
SPDW
SPDW sump
with compressed air pump
approx. 10m
NOT TO SCALE

FIGURE 1

SEA WATER DESALINATION SYSTEM - KISH WATER SUPPLY SCHEME

- **Diagrammatic Sketch - <u>not to scale</u>**

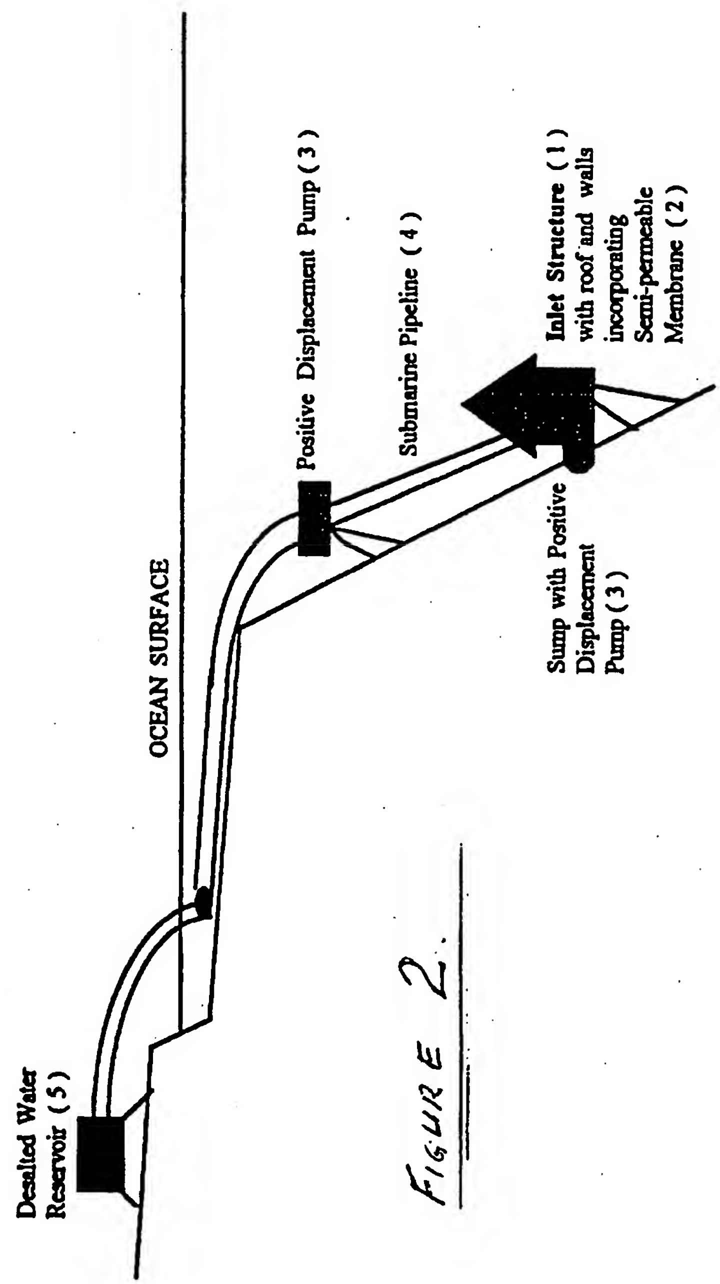

FIGURE 2.

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/AU 97/00152

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl^{6}: C02F 1/44

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC^{6} C02F 1/44

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU : IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
DERWENT

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	AU,A, 56082/94 (GLOBAL WATER TECHNOLOGIES) 9 June 1994	
A	US,A, 4770775 (FERNAND) 13 September 1998	
A	US,A, 4414114 (BURKHARD et al) 8 November 1983	
A	FR,A, 2484391 (FERNAND) 18 December 1981	

[X] Further documents are listed in the continuation of Box C

[X] See patent family annex

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INTERNATIONAL SEARCH REPORT

International Application No.
PCT/AU 97/00152

C (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE,A, 2722975 (DRUDE et al) 23 November 1978	
A	DE,A, 2719907 (DRUDE et al) 9 November 1983	
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International Application No.
PCT/AU 97/00152

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
AU	5608294	WO	9412267	US	5366635		
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END OF ANNEX